# *Concept: The space program has had both benefits and costs for Earth's inhabitants.*

● Give some examples of recent spinoffs of the space program, including microminiaturization of electronics, lightweight materials, solar panels, computerized scanning medical devices, portable x-ray machines, automatic utility meter reading devices, compact water filters, automatic inventory cash registers, high intensity lights, water-cooled headbands, fabrics made of strong chemical bonds, and microcomputer software. Have students research their own list. Have teams of students report on an item, whether the work it does was possible before its space application, and how the work it does changes lifestyles on Earth. Have the students illustrate their reports.

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*Have students pursue spinoff technologies in more detail. Teachers can locate materials through NASA Teacher Resource Centers.*

*a. Assign a group of students to develop a catalog of spinoff products.*

*b. Have students locate information on specific products and report how they are linked to the space program, e.g., fabric used for the Pontiac (Detroit) Silverdome, heat absorbing clothes for athletes, NASTRAN computer structural analysis program, and plastic welding.*

*c. Challenge students to create a "Technological/Economic Impact" statement highlighting and analyzing the impact of spinoffs. This could be reported in traditional oral or written formats or as a video news report format. Challenge a second group of students to create the opposite scenario, "What If We Had Not Pursued the Space Program" and to report it in a "Point-Counterpoint" format.*

*Although the spinoffs seem to have improved life on Earth, some individuals and groups believe that the technology has also brought increased costs. Do a cost-benefit analysis and debate the issue.*

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● Weather satellites are another benefit of space technology. Students may wish to research and report the following areas: forecasting, television reporting, the meteorological satellite system, economic impacts of weather satellites, and the potential issue of controlling the weather. Students could prepare video news reports or "white papers" on controversial aspects of the topic.

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*Present a hypothetical situation in which you are NASA and want to hire a contractor—four students—to manufacture certain parts for the Space Shuttle. Give the four students a sum of play money and a period of time to "manufacture" some meal packs for the Shuttle. Then have them dispose of their money in the economic community—the rest of the class. Use this activity to lead into the concept of circular flow of goods and services. Have students generalize about the impact of NASA spending.*

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● Many of the economic impacts of NASA are first felt on a local level. The areas surrounding the Johnson Space Center in Texas and the Kennedy Space Center in Florida are obvious examples. Students may want to generalize about the potential impact of a NASA facility on a community, discussing increased retail sales, employment, increased per capita income, and accelerated road and building construction.

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*Have students speculate about the future economic impact of space travel and colonization. They may want to use a decision-making model to decide a hypothetical issue, such as whether a space colony should be established. The key concept would be the economic impact of the colony.*

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● Offer the following research opportunity: In past decades, "urban renewal" has been a highly controversial topic. The current trend of "revitalization," a mix of refurbished and new construction, is a parallel. Direct students to locate information on the impacts of this trend and to compare it with renewal. Discuss the implications for life in space.

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*Challenge students to investigate the regulation of communications satellites (orbits and relay frequencies). They may approach it in an international economic or legal context at the present time or at some future age.*

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● Although the Shuttle itself is reusable, the equipment and items for crew life aboard the Shuttle may be disposable. Have students list items used aboard the Shuttle and indicate whether they are reusable or disposable. Discuss the difference between the terms "reusable" and "recyclable." Have students determine whether any disposable items could be recycled and discuss the feasibility of such an idea.

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*Discuss advantages and disadvantages of robotics in space and on Earth.*

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● The TDRSS (Tracking and Data Relay Satellite System) is an example of the potential benefits of the current flight. Mission 51-L will deploy TDRS-B, the second of three communication satellites that will allow almost full-time coverage of the Shuttle and up to 26 other satellites. Present several scenarios that involve communications satellites such as an important news story breaking in Europe, a long-lost relative calling from Latvia, or worldwide viewing of the Olympic games. Discuss how communications satellites are involved in each example and how the quality, speed, and reliability of the communications would be affected without the use of satellites.

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*Have students address the questions that follow in small groups, debates, written essays, or discussions.*

*a. Why were previous spacecraft not designed to be reusable? (technological limitations, changes in budgetary policies, and cost increases)*

*b. What advantages are provided by this Space Shuttle design? (more economical in terms of dollars per payload, resource conservation, ability to repair inoperable satellites, two-way transportation)*

*c. What considerations in terms of reuse are involved with the Space Station or other "permanent" space facilities? (similar economic considerations)*

*d. Consider products and packaging involved in your everyday life that could and should be recycled.*

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● Have a group of students prepare a collage of magazine pictures or a mural showing space technology at work in their community. Communities may allow these murals to be painted on or displayed in shop windows.

# Concept: The space program generates experimentation in a variety of scientific fields.

● Provide students some background on the use of crystals in communications. Explain that the space program has extended the opportunities for scientists to study and grow useful crystals. Discuss the potential benefits of growing a crystal in a microgravity environment.

*Ask students to defend or refute Isaac Asimov's idea: "Another kind of structure in outer space is factories. There is no reason why a good proportion of our industrial factories couldn't be placed in orbit. Pollution that it produces can be discharged into space."*

*Explore the following thought questions:*

*a. How does the process of growing a crystal of germanium or silicon differ from growing crystals of sugar or salt?*

*b. How would microgravity make purifying metals easier?*

*c. What is the advantage of containerless processing of materials over heating them in ceramic containers on Earth?*

*d. Why do some materials form crystals and others do not?*

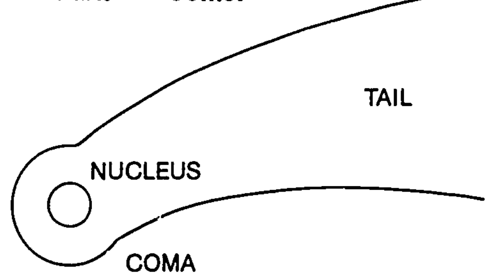
● Ask students to prepare two advertisements that would convince manufacturers to conduct experiments aboard the Shuttle. One group could do a magazine advertisement; the second, a radio or television advertisement. Generate ideas in a brainstorming session.

**Objectives:**

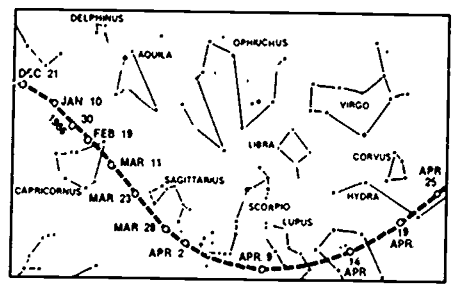
1. To describe the structure and behavior of the Comet Halley
2. To draw a comet and label its parts
3. To explain that light radiation exerts pressure
4. To place ultraviolet radiation in the electromagnetic spectrum correctly and compare its wave lengths to that of light

1. Explain to students that on Flight Day 3, the Spartan astronomical instrument was deployed from the payload bay to examine the tail of Comet Halley. At this time, radiation pressure from the Sun will make the sublimation of materials from the head of the Comet the greatest. The ultraviolet spectrometers on the Spartan will tape record Comet radiation invisible to the human eye. The Spartan unit was retrieved by the Shuttle on Flight Day 5. When returned to Earth, the data will be analyzed and compared to other ultraviolet data gathered by Spacelabs and satellites to help us understand the Universe.
2. Ask students who have recently observed Comet Halley to describe their sightings to class members. List pertinent facts on the chalkboard. Show a chart or diagram of the Comet's structure and orbit. Have students use the chart to locate the Comet's position in reference to the Sun–Earth orbit on the day of sighting.
3. Have students draw and label the parts of the Comet.
4. Have students discuss why the tail is visible only when the Comet is close to the Sun. Use dry ice to represent the Comet, a flashlight to represent the Sun's light, and a vacuum cleaner's blower-end attached to the flashlight to represent the solar pressure of light. Darken the room. Have a student circle close to the "Sun" carrying the tray of dry ice while the blower directs the sublimating gas away from the coma. Observe that the gaseous tail is always streaming away from the Sun. Question students as to which parts of the demonstration are similar to Comet Halley's trip close to the Sun. Explain that the pressure of light is due to tiny particles called photons. Light can exist in fact as both wave and particles. The pressure of our Sun's light is called the solar wind in space.
5. Exhibit a "dirty snowball" with a rock core. Explain that in the vacuum of space, ice changes to gas without melting (sublimation). The dirt becomes the dust of the tail, and the particles in the rocky core eventually disintegrate to dust. We see them as meteors in our upper atmosphere.
6. Darken the room and demonstrate one property of ultraviolet light by shining an ultraviolet (UV) light source on "glow in the dark" materials. Clap erasers near the beam of the UV source to see if eraser dust appears different under UV than in normal light. WARNING: *Do not allow students to look directly at the bulb. The light could burn the eye's retina.*
7. Show where UV radiation is located on the electromagnetic spectrum chart. It has shorter wavelengths than visible light, but not as short as x-rays. Explain that astronomers have used space-orbiting spectrometers sensitive to UV to study dust clouds, our Milky Way, and other galaxies. They want to compare the effect of our Sun's UV on Halley's dust.

**Parts of a Comet**




**MOVEMENT OF COMET HALLEY**




| | |
|---|---|
| **Late Jan. to Feb., '86** | Comet at its brightest but cannot be seen from Earth as it circles the Sun. |
| **Feb. 24, '86** | Comet reappears in early morning sky, just before sunrise, a few degrees above the eastern horizon. |
| **Mar. 6, '86** | Comet visible, perhaps with a small tail, 5 degrees above the eastern horizon during dawn twilight. |
| **Mar. 26, '86** | Comet 10 degrees above southeast horizon in pre-dawn morning. Its tail may reach up to 20 degrees or more. |
| **April 10, '86** | Comet 10 degrees above southern horizon at the crack of dawn. Comet should be at its brightest. |
| **April 11, '86** | Comet begins its journey outbound. |
| **April 12, '86** | Comet visible before dawn in the southwest and after sunset in the southeast. |
| **April 17, '86** | Comet 7 degrees above the horizon after sunset in the southern sky. |
| **Late April, '86** | Comet fades from unaided vision. |

# *Concept: The space environment is a catalyst for creative expression in art, music, and literature.*

● Review with students the music that throughout history has resulted from exploration, migration, and conquest: the sea chanty, Appalachian folk songs, Negro spirituals, Western ballads. Trace the development of each from their sources to 20th-century interpretations. Then challenge students to create a comparable musical form and expression for space. Have them write a paragraph about their reasons for choosing the style, instrumentation, and lyrics.

*Challenge music students to imagine that they have been named to compose the theme music for a space mission. Ask them to identify their musical style. Then ask them to identify the moment their composition would begin—launch, orbit, sleep, space walk. Next, ask them to identify the mood or feeling of a piece that best shows the kind of work they would compose. Ask them to compose a given number of measures.*

● To commemorate the 50th anniversary of the National Society of Professional Engineers, Richard Bales composed *The Spirit of Engineering* for orchestra. Have students consider what kind of music would capture the Spirit of Exploration, of Science, of Learning, or of Mission 51-L (chamber music, a march, a chorale).

*Have students research and report on "What effect has space exploration had on music?" including a discussion of improved recording techniques as a function of advanced electronic technology and the use of electronics in music composition and performance.*

● Read the story of Gian Carlo Menotti's opera, *Help, Help, The Globolinks!*, to students and discuss with them the qualities that make it a space-age opera. High school students might consult with a local opera association about producing it.

*Challenge students to agree or disagree with novelist James Michener's comments at a NASA symposium on "Why Man Explores." "I have always believed that an event has not happened until it has passed through the mind of a creative artist able to explain its significance." Have them put their ideas into a piece of persuasive composition.*

● After discussing the modules of a space station, have students draw their own concepts and develop their ideas from preliminary sketches to detailed drawings to finished paintings or prints.

*Have students depict a Space Station in different pictorial styles (e.g., realism, expressionism, abstract). Have them paint two views: (1) the Space Station seen from the Shuttle and (2) the view from the Space Station. Then have them select one of the compositions to explore a variety of techniques—water color, oil, tempera, and collage.*

● Have teams of five to eight (the numbers of the Shuttle crew) students draw cross sections of the interior of the middeck area of the Space Shuttle. Challenge each team to choose a color and decorating motif to use in their drawing. The interior of the Shuttle orbiter is white. Discuss color likes/dislikes of individuals, and how various colors affect moods and sense of space. Have the students compare the colors of their classroom, the cafeteria, gymnasium, and a room at home and discuss the reasons why specific colors are selected. Have each student describe his/her personal preference for the interior design of the orbiter and then, what modifications might have to be made to accommodate the tastes of other crew members.

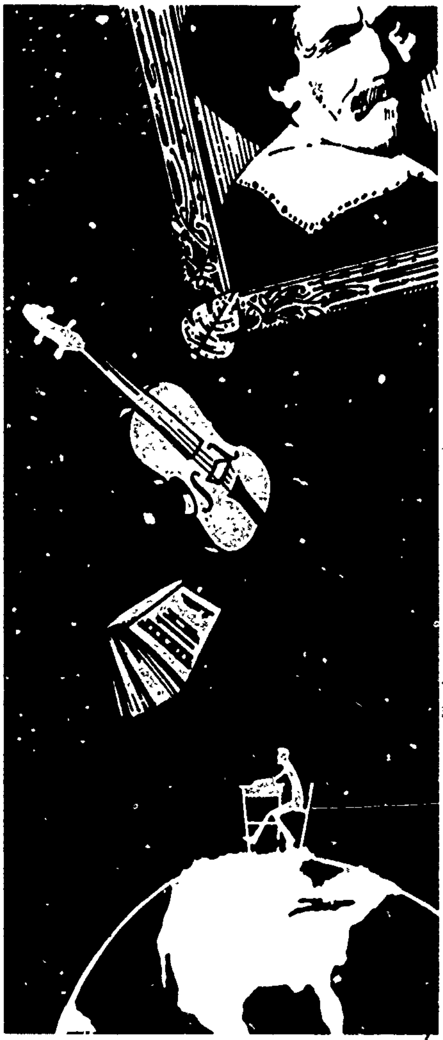
*Discuss how artists interpret their awareness of the world: some paint directly from nature, some from experience and memory, some from sketches of nature, and some from imagination. Have students think about how an artist would work during a spaceflight.*

● Read poems that mention heavenly bodies, aerospace personalities, and space objects—from nursery rhymes to modern poets—and compare fanciful literature with fact.

*Read Gore Vidal's* Visit to a Small Planet *and discuss how the alien visitor is like/unlike Earthlings. Read Edmond Rostand's* Cyrano de Bergerac *—are any of the means of spaceflight devised by Cyrano plausible?*

● Talk with students about science fiction authors—Isaac Asimov, C.S. Lewis, Jules Verne, H.G. Wells, Arthur C. Clarke. Read passages from some of their works and assign their books for reports. Discuss with students whether any of the ideas predicted by the authors already may have come to pass.

*Astronaut Jeff Hoffman is an astronomer. Ask students to listen to his description of space and to discuss his word choice and sequence of details which enrich his narration. "The sight of the ice particles in front of the Shuttle is like...fireflies...They're different colors. Some of those sparkles out there are red...most of them are white ...some really bright ones out there....And as the Sun sets on the orbiter, the ice crystals go out. The last few of them turn red. Then they're red. Then they're gone." Later he says, "When you look outside and see the black of space and the ice crystals following us around and the sunrise and sunset every hour and a half, look out and see the lightning storms flashing, the cities making their light patterns beneath the clouds, the patterns in the ocean, flying over the Himalayas as we do the last two orbits tonight, then I know I'm really in space."*



# *Concept: The space program engenders diverse reports, stories, and other forms of communication.*

● Have students role-play a news correspondent assigned to cover the flight of the Teacher in Space. Ask them to write the news story and a feature story based upon one phase of the event.

*Astronaut Jeff Hoffman kept an audio diary of his April 1985 mission Discuss how this is an example of oral history. Talk with students about the function of oral history. Order a copy of his tape from the National Public Radio Catalog. (See Resources.) After listening to it, discuss if it is more moving to hear rather than to read his words.*

● Oral communication is a vital function of the space effort. Have your students help you make a flow chart of the kinds of roles and functions of oral communications during the launch, orbiting, and reentry of the Shuttle. Help them to understand that for each speaking role, there is also a listening role.

*Brainstorm the ways in which communication skills of reading, writing, listening, and speaking are used in training for and during a mission.*

● McAuliffe is keeping a journal of her experiences. List individuals in history who have kept diaries. Discuss why diaries have been important to later generations.

*The second Space Flight Participant will be a journalist. Have students consider the reasons why one of the writing professions was selected and what other writers might like to make a Shuttle flight (poets, science fiction authors). Ask students what other communications professions will probably be represented in the Space Flight Participant Program and list them in order of importance.*

● The Mission launch and its ongoing coverage expose students to the jargon of space. With your students, begin to make a list of all terms which have been "coined" by the space program. Place each term or acronym with its definition on a file card. Begin to post them around the room, adding new ones in alphabetical order.

*As Mission 51-L progresses, have students collect all news articles, pictures, and any other graphic details which they find. At the conclusion of the Mission, make a class collage, emphasizing the details which the class [illegible] most significant.*

● Ask each student to choose a favorite part of the mission which was shown on the live lesson. Allow the student to choose his/her best way of communicating information about that part: oral report, written paragraph, news report, dramatization, role playing, etc.

*Identify key events in the history of spaceflight and express them in a workable chronology. Speculate about future events in space.*

● Use Comet Halley as a springboard for historical investigation. The reference dates for its returns are 1652, 1758, 1835–1836, 1910, 1986, and 2062. Key question: What has life been like during past returns of Comet Halley? What do you think life might be like during the next appearance in 2062?

*Possible projects:*

*a. Time capsule approach. Have students create a time capsule that depicts life in the United States in 1986. Have them compare the contents of their capsule with the expected contents of other reference years using inventory lists of facsimile artifacts.*

*b. Time frame approach. Have students imagine that a video is being made entitled "History of the World, Part I." It will include everything from the beginning until now. Their task is to prepare—either visually, orally, in writing, in skits, or in video-vignettes—the frames or scenes from those reference years in which Comet Halley was present. Themes in their time frames can include styles, housing, technology, food and agriculture, currency, manufacturing, important people and events, types of governments, medical science, social and economic conditions, music, dance, and entertainment.*

● Discuss the relationship of the following events to historical themes:

**a.** Do you think there is a space race? Why and how did it develop?

**b.** What other themes and events paralleled the space race?

**c.** What social themes are linked to space history?

**d.** What evidence is there that international competition was replaced by cooperation?

**e.** How have economic themes affected the space activities?

***Objectives:***

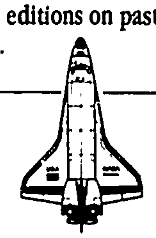
1. To write articles that can be submitted to a student newspaper
2. To publish a student newspaper about space and the Teacher in Space

1. Technological improvements in satellite communication have enabled publishers to print newspapers with national appeal. Television and radio news receive and send their messages via satellite and microwaves, enabling us to follow newsmaking events. The Teacher in Space project will be no exception. While the commercial media carry the event, students can track the mission from their own perspective, in their own newspaper.
2. Distribute current newspapers to groups of students. Discuss the functions of different kinds of stories and help the students identify the parts of the newspaper: news articles, features, editorials, comics, and advertisements, etc. How might newspapers be similar or different in the future?

   **a.** Identify information about Mission 51-L which would make a good news or feature story. Divide the class into small groups to write news stories.

   **b.** Discuss Mission 51-L. List the kinds of products which could be the subject of advertisements. Ask students to divide into groups. Have each group select a product to advertise in the newspaper, e.g., a space suit, a space meal, or a trip. Challenge each group to design an advertisement for the newspaper, complete with illustration, prices, and details likely to attract sales.

   **c.** Divide the class into three groups to express their opinions on the Teacher in Space project. One group will write editorials, one the letters to the editor, and the third the cartoon.
3. Using the students' articles, publish a class or school newspaper which records events about Mission 51-L and space in general.
4. To complement the student-produced newspaper on the present mission, challenge students to prepare editions on past and future space missions.



# *Concept: As humanity's presence in space grows, so does the future need for laws and decision making.*

● List potential problems of law and governance in space: rights of space travelers, repatriation of downed astronauts, liability problems, ownership or control of heavenly bodies or areas. Investigate the current status of law in space. To introduce the topic, present the following problem:

> Geosynchronous satellites orbit above Earth. Who determines right of way for these orbits and who assigns transmission frequencies? (The United Nations. The International Telegraph Union, ITU, has a special arm, the World Administrative Radio Conference, WARC, to make such allocations.)

Assign students to research the network of U.N. and intergovernmental space agencies which establish and enforce space laws.

*Have students research existing guidelines and principles for space government. Provide copies of the provisions of the Treaty on* Principles Governing the Activities of States in the Exploration of Outer Space, Including the Moon and Other Celestial Bodies *opened for signature by the U.N. General Assembly in 1967. Discuss with students why it is called the Magna Charta for space. (See Illustration below.)*

● Give specific examples of circumstances that the students could classify by the appropriate treaty provision. For example, "A country cannot claim territory in space." "A country should regulate the space activities of its citizens." (See Illustration below.)

*Encourage students to create editorial cartoons or vignettes involving the special problems of space law.*

● Have students design an outer space regime as they believe it should function. The Star Trek Federation is a good hypothetical example. Some issues surrounding the creation of the regime may be one nation–one vote versus votes based on contribution, enforcement, jurisdiction, and courts.

> *"Tonight I am directing NASA to develop a permanently manned space station — and to do it within a decade."*
>
> *—Ronald Reagan, State of the Union Address, January 25, 1984*

*Ask students why the President made that decision, committing vast amounts of national resources at a time when budget deficits were rising.*

*Introduce the concept of a decision-making model or process. Use examples of other pivotal space decisions, such as the lunar landing, or ask students for their ideas of other historical decisions. Reinforce the concepts of goals, alternatives, and expected outcomes.*

● Use the Spaceship Decision-Making Model (See Illustration p. 4.) to "walk through" the Space Station decision with the class. Apply the Model to a variety of space-oriented problems. Historical decisions may be researched and evaluated in terms of "accuracy." Present decisions may be followed closely, while future decisions may be considered. These may be done individually, in small groups, or as a whole class.

a. Historical Decisions
   1) Creation of NASA
   2) Kennedy's goal of reaching the Moon before 1970
   3) Participation of other countries in early space efforts
   4) Continuation of Apollo after 1967 deaths
   5) Inclusion of women as astronauts
   6) Apollo/Soyuz joint mission
b. Current Decisions
   1) Sharing scientific data with other nations
   2) Use of Earth observation satellite data by governments
   3) Cost factors
   4) Manned vs unmanned space missions
c. Future Decisions
   1) Space colonization
   2) Space manufacturing or mining facilities
   3) International space ventures
   4) Landing on other planets

**A Treaty of Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies. The Treaty was opened for signature on January 27, 1967. This "Outer Space Treaty" or "Space Charter" has been characterized by some as a Magna Charta for space. Treaty provisions declare that:**

**(1)** International law and the Charter of the United Nations shall apply to space activities.

**(2)** Outer space and celestial bodies are the province of mankind and shall be used only for peaceful purposes and for the benefit of all mankind.

**(3)** Nuclear weapons, weapons of mass destruction, military bases, and military maneuvers are banned from space.

**(4)** Outer space shall be free for exploration, use, and scientific investigation.

**(5)** There can be no claims of sovereignty or territory by nations over locations in space, "by means of use or occupation or by any other means."

**(6)** Jurisdiction over space objects launched from Earth shall be retained by the launching state.

**(7)** Private interests are recognized as having freedom of action in space, so long as a government or group of governments on Earth authorize and exercise continuing supervision over their activities. Signatory nations (seventy-eight at last count, including the United States and the Soviet Union) are therefore under a duty to oversee the activities of their citizens and commercial ventures in space.

**(8)** Governments are liable for damage caused on Earth by their space objects.

**(9)** Astronauts are "Envoys of Mankind" and are entitled to noninterference and all necessary assistance in distress.

**(10)** The natural environments of celestial bodies should not be seriously disrupted, and Earth must not be contaminated by extraterrestrial organisms.

# NASA Teacher Resource Centers

Teacher Resource Centers at major NASA installations provide easy access to NASA-related materials that can be incorporated into the classroom at all levels. The materials reflect NASA research, technology and development in a variety of curriculum and subject areas. Resources available include NASA videotapes, 16mm films, 35mm slides, NASA publications, audio cassettes, computer software, laser discs, teacher's guides, and classroom activities. Educators can review the material and request copies for use in their classrooms. The only charge is the cost of reproduction and mailing. Visit or contact the Teacher Resource Center nearest you for information about services and materials:

ALABAMA SPACE AND ROCKET CENTER
Attn: NASA Teacher Resource Room
Tranquility Base
Huntsville, AL 35807
(205) 837-3400, Ext. 36

NASA AMES RESEARCH CENTER
Attn: Teacher Resource Center
Mail Stop 204-7
Moffett Field, CA 94035
(415) 694-6077

NASA GODDARD SPACE FLIGHT CENTER
Attn: Teacher Resource Laboratory
Mail Stop 130-3
Greenbelt, MD 20771
(301) 344-8981

NASA JET PROPULSION LABORATORY
Attn: Gil Yanow
Science and Mathematics Teaching Resource Center
Mail Stop 180-205
Pasadena, CA 91109
(818) 354-6916

NASA LYNDON B. JOHNSON SPACE CENTER
Attn Teacher Resource Room
Mail Stop AP4
Houston, TX 77058
(713) 483-3455 or 4433

NASA JOHN F. KENNEDY SPACE CENTER
Attn: Educators Resource Library
Mail Stop ERL
Kennedy Space Center, FL 32899
(305) 867-4090 or 9383

NASA LANGLEY RESEARCH CENTER
Attn: Langley Teacher Resource Center
Mail Stop 146
Hampton, VA 23665-5225
(804) 865-4468

NASA LEWIS RESEARCH CENTER
Attn: Teacher Resource Room
Mail Stop 8-1
Cleveland, OH 44135
(216) 267-1187

NASA NATIONAL SPACE TECHNOLOGY LABORATORIES
Attn: Teacher Resource Center
Building 1200
National Space Technology Laboratories, MS 39529
(601) 688-3338

NASA Regional Teacher Resource Rooms have been established at the following institutions:

Mr. Richard P. MacLeod
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U.S Space Foundation
P.O. Box 1838
Colorado Springs, CO 80901
(303) 550-1000

Mr. Barry Van Deman
Museum of Science & Industry
57th Street and Lakeshore Drive
Chicago, IL 60637
(312) 684-1414, Ext. 432

Dr. Kenneth Pool
School of Education
University of Evansville
1800 Lincoln Avenue
Evansville, IN 47714
(812) 479-2766

Mr. Scott Seaman
Director, Learning Resources Division
Northern Michigan University
Marquette, MI 49855
(906) 227-1300

Ms. Carolyn Cooper
Olson Library Media Center
Northern Michigan University
Marquette, MI 49855
(for materials only)
(906) 227-2117

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(313) 370-3079

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(414) 765-9966

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University of Wisconsin at LaCrosse
LaCrosse, WI 54601
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# RESOURCES


*An Astronaut's Journal by Jeff Hoffman.* National Public Radio, 1985. (Orders to National Public Radio, P.O Box 55417, Madison, WI 53705. 1-800-253-0808 except Wisconsin and Alaska. $12.95 including postage. Free Catalog.)

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________. *Social Sciences and Space Exploration.* Washington, D.C : U.S Government Printing Office, 1984.

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